Joint Working Group on Luminosity

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CDF and D0 data from

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Beam Widths/β*

- CDF and D0 fit their beam widths in x and y as a function of z to get β*, the emittance, ε, and the position of the beam width minimum, z_0.

The formula they use for these fits is:

$$\sigma_{beam} = \sqrt{\varepsilon\beta^* + \frac{(z - z_0)^2}{\beta^*}}$$

Beam Widths/ β*

- For the luminosity calculation based on β* we assume that L is inversely proportional to $\sigma_x \sigma_y$ and that

$\sigma_{beam}(x) = \sqrt{\varepsilon_x \beta_x *}$

and that

$\sigma_{beam}(y) = \sqrt{\varepsilon_y \beta_y *}$

CDF/D0 Comparison

store	time	βx cm	βx cm	βy cm	βy cm	εx cm rad	εx cm rad	εy cm rad	εy cm rad	L E30	L E30
		CDF	D0	CDF	D0	CDF E-7	D0 E-7	CDF E-7	D0 E-7	CDF Peak avg	D0 Peak avg
2985	3/09 03	32.3 ±1.77	63.5 ±1.29	35.7 ±2.44	54.7 ±0.84	1.28 ±0.05	0.91 ±0.02	1.09 ±0.05	1.07 ±0.01	35.4 21.4	31.6 19.4
3120	31/12 04	36.5 ±2.44	68.0 ±2.27	33.6 ±3.12	50.8 ±0.90	1.29 ±0.06	0.83 ±0.02	0.80 ±0.04	1.26 ±0.02	28.1 15.0	26.5 14.4
3123	2/01 04	42.4 ±2.15	60.2 ±1.33	41.9 ±2.41	51.5 ±0.70	1.43 ±0.05	1.12 ±0.02	1.07 ±0.04	1.54 ±0.02	45.8 20.4	41.9 19.4

CDF/D0 Comparison

store	$\sigma x \sigma y$	$\sigma x \sigma y$	$1/\ \sigma x \sigma y$	$1/\ \sigma x \sigma y$	L_{CDF}/L_{D0}	L_{CDF}/L_{D0}	L_{CDF}/L_{D0}
	CDF	D0	CDF	D0	β^*	peak	avg
2985	40.110	58.155	0.0249	0.0172	1.45	1.12	1.10
3120	35.579	60.104	0.0281	0.0166	1.69	1.06	1.04
3123	52.142	73.127	0.0192	0.0137	1.40	1.09	1.05

CDF/D0 comparison

- CDF seems to have higher luminosity than D0 at the 5-10% level based on the luminosity counter measurements.
- CDF seems to have higher luminosity than D0 at the 40% level using the β^* method.

  (Although the method used to predict relative luminosities based on the β^* values is not accurate, there seems to be significant inconsistency between the two methods and the experiments need to keep crosschecking)